

ventromedially and sparsely spinulose, the spinules minute and in short rows; palp subcylindrical, with four apical (two with a cap and two with a spinule) and one subapical (with a spinule) sensilla; galea a tall frustum with two apical sensilla, each bearing a spinule. Labium with the anterior surface sparsely spinulose, the spinules exceedingly minute and in short transverse rows; palp a short peg, with four apical (two with a cap and two with a spinule) and one subapical (with a spinule) sensilla; opening of sericteries a short slit on the anterior surface. (Material studied: six larvae from Turkestan.)

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ZOOLOGY.—*Valletofolliculina bicornis*, a unique new genus and species of folliculinid (*Ciliata: Heterotricha*) from California. E. A. ANDREWS, Johns Hopkins University. (Communicated by Edward G. Reinhard.)

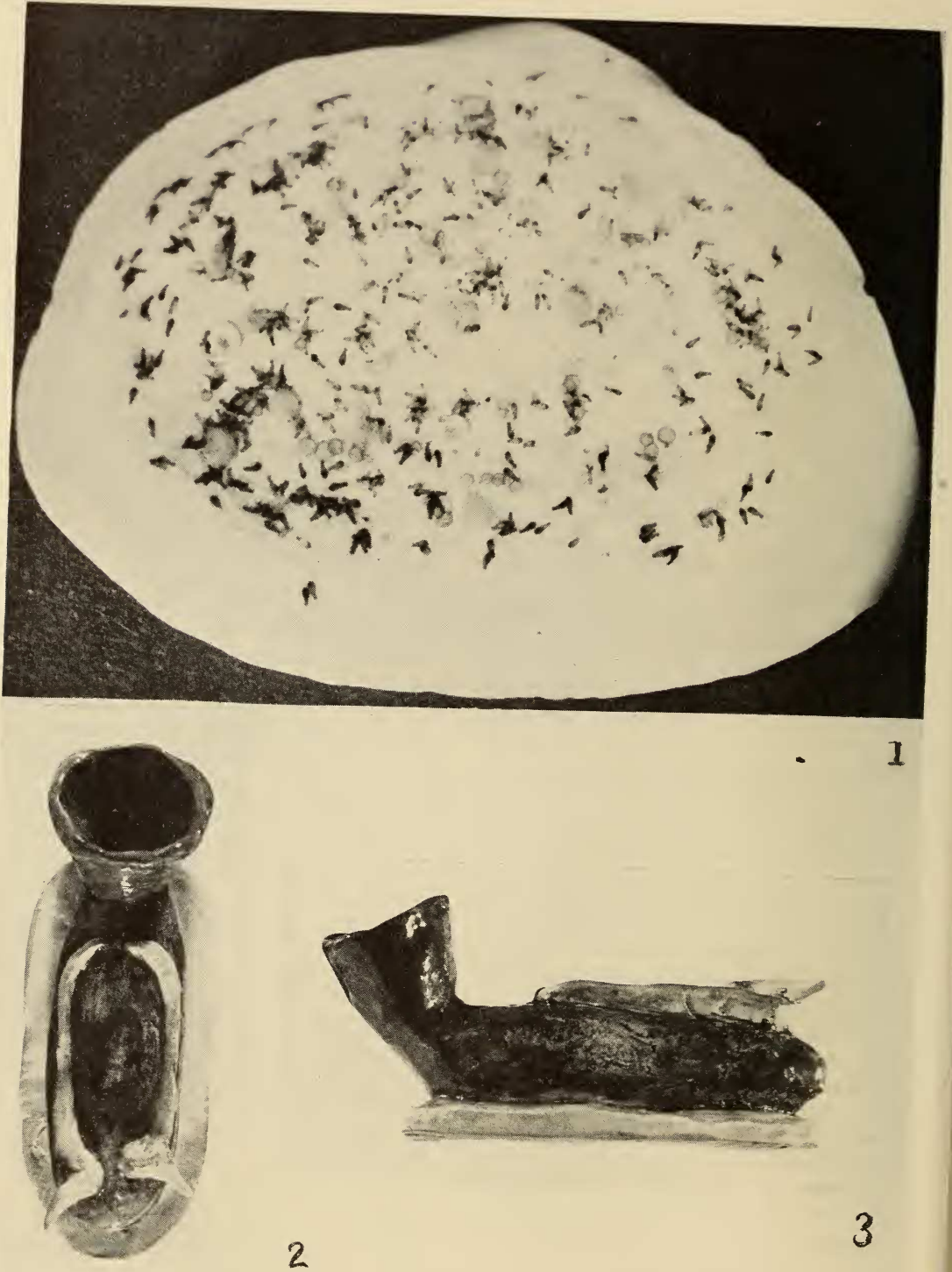
Ciliated Protozoa of the family Folliculinidae are found in the Atlantic and Pacific, north and south, living each in its own bottlelike dwelling, theca or test, but each is capable of doing away with its complicated feeding apparatus and assuming a simplified actively swimming phase. This swimming phase is of brief duration and ends in the making of a new dwelling like the former one. These tests are chitinlike and durable and present differences in size, form, and structure used to distinguish species and genera.

Some tests sent me from California represent a new species and genus as having sculpturing unlike that of any known form, of which 68 species and 28 genera are found in the great work of Hadzi (1951). These tests were very abundant on all small bivalve shells dredged April 7, 1951; but at the same place none were found in July; so it is feared these folliculinids may be nomads, as others in the Chesapeake (Andrews, 1950), and not readily found again to furnish the needed information as to how these tests originate. As yet we have only preserved tests and no information about the living animal.

DESCRIPTION

As seen in the photograph (Fig. 1), the tests stand in small groups scattered over all the inner face of bivalve shells except the border, which is

clear as probably being on the ground where the shell lay inside down. Apparently there was access above at the raised umbo into the quiet water area under the shell, so that the folliculinid swimmers went in in conformity with the habit of folliculinids to settle in depressions, cavities, or circumscribed areas. In any group (Fig. 5) it is noteworthy that the tests stand radiating outward from a vague center: often two side by side or at angles to one another, giving the impression that when parking in a group the swimmers had been influenced by each other. Each test (Figs. 2-4) has a very much elongated pear shape, lying attached most of its length as a body with rounded posterior, tapering gradually to a slender neck that rises upward, as seen in side view (Fig. 3). From the narrowest front of the neck suddenly flares out a wide funnellike mouth, suggesting a convolvulus flower. Quite unique is the presence of two ridges, like ramparts, along the right and left edges of the roof of the body of the test. These ridges converge anteriorly to dwindling points but posteriorly to swellings, each of which is produced as a horn that rises upward and outward. The two swellings and horns are generally not opposite, but either the right one or the left one is nearer the hind end of the test. It is to be emphasized that the horns and the ridges are not solid, but hollow, each being a space covered with membrane as is the main dwelling space. Thus there are five separated cavities: the main dwelling cavity, the two of



Figs. 1-3.—Photographs of tests of *Valletofolliculina bicornis*; n. gen., n. sp., by John Spurbeck: 1, Inner face of isolated shell of a small bivalve, thickset with tests, in scattered groups (some vague rounded objects are *Cyanea scyphistomas*); 2, top view of ceramic model of a test; 3, side view of another model of a second specimen.

the ridges, and the two of the horns. The roof of the dwelling space cuts it off from both ridge spaces, and the membrane of each ridge space cuts it off from the cavity of its horn.

In paraffine sections each horn has a somewhat pyramidal base continued as a long tapering cylinder, ending abruptly as if truncated, with small rounded end that seems roughened under low powers but under immersion lens presents 20 to 30 projecting hollow spines estimated as 20 to 50 μ long, of uniform, more than one μ diameter, as if tubular outgrowths of the membrane covering the horn and open at each end.

As seen in Figs. 2-4, the colletoderm or cement that fixes the test to the substratum is wide and well defined, forming a halo about the test body as seen from above. When it and the test are scraped off from the substratum together, its width brings it to a horizontal position of rest even in such viscid mounting media as "permount" of the Fisher Scientific Co. of New York; hence side views of the tests are difficult to obtain, though tests on vertical parts of shells (as on left of Fig. 1) show side views. In cross section (Fig. 6) the cement runs far out right and left beyond the floor it forms for the test; hence when the test is removed from the cement, as in Fig. 7, there is a long narrow vacancy ending sharply in front representing the floor of the test. The boundary of this space is comparable to the "water line" of ship building which runs toward a point under the bows. Note in Fig. 6 that while a hollow ridge is cut on the left a swelling and horn are cut on the right, as being nearer to the posterior end of the ridge.

The tests are large enough to be plainly seen on a white background, Fig. 1, and yield the following measurements, in μ . Fifty tests ranged from 550 to 795, with average of 635; however, these were measured straight from mouth to hind end and hence somewhat less than whole length if measured on the side along the horizontal body and uprising neck. Forty-six tests gave body widths of 106-265, with average of 198. Fifty-one specimens had neck widths 90-116, average 101. Forty-two specimens gave mouth widths of 148-212, with average 179: thus often twice as wide as the neck just below it. When side views are obtained it is evident that here, as in many folliculinids, the test is somewhat flattened, the depth being less than the width. With the above average body width of 198, three depths were 104, 125, and 206; and for the above neck width

average of 101, three measurements of depths were 78, 90, and 100. The body dwindles forward not only in width but also in depth; one was 125 deep posteriorly but only 100 anteriorly, where becoming the neck.

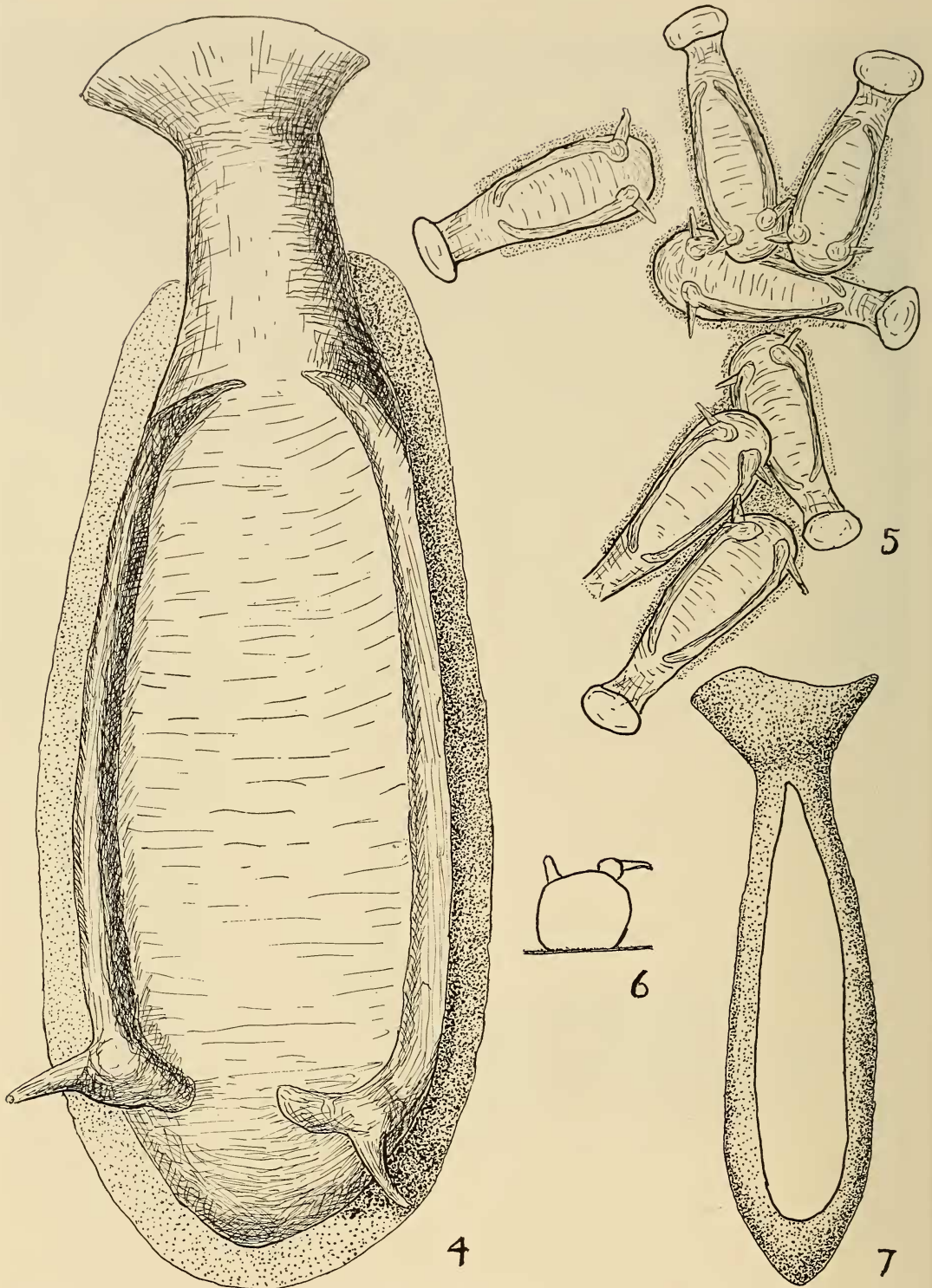
Some other measurements follow. The cement stands out beyond the test as seen from above, like a halo 20 to 78 wide. The ridges are 10-78 in height. The anterior tips of the ridges are 88-120 apart, leaving about 20 spaces from the edge of the body. The horns range from 75 to 125 in length and may be quite unequal, as 78 on the left and 125 on the right. Their tips stand 100-150 apart.

The meganucleus is spheroidal and measured 52, 56, 60, and 60 in diameter of four specimens; over it the color stripes were about 5 μ apart. The food vacuoles are generally anterior to the nucleus; some few were in the peristomial lobes. In one specimen a large object 35 μ long was going into the oesophagus, which was 85 from the tip of the lobes.

The dark green of the animal is lighter in the test where the ridges are rather red-brown, while both cement and horns are colorless.

This new folliculinid from California has considerable resemblance to one called *Parafolliculina roestensis* by Dons, who (1931) dredged it on shells in similar latitudes of the west coast of Norway; both have wide halos of cement about long pear-shaped recumbent tests with short necks ending in wide flaring mouths, and photographs of both show like clustering in small colonies. But Dons makes no mention of dorsal ridges, yet speaks of a local thickening of 40 μ in position corresponding to one of the posterior swellings of the new species, a resemblance increased by the occurrence of an abnormality in one of our specimens in which one ridge bore two blunt elevations in place of the usual swelling and horn. However, Dons' species had a characteristic median pouch from the main cavity at the foot end and two valves that were right and left plates, a feature not found in any other folliculinid. The California specimens looked so much like Dons' figures we expected to see lateral valves and for a time so interpreted the sides of the neck rising from the cement! Some future observations may decide if possibly Dons was misled as to the presence of lateral valves!

Hollow dorsal ridges along the roof of the body of the test being something known only in this new Californian species, we deem it of generic



FIGS. 4-7.—Camera-lucida sketches of tests of *Valletofolliculina bicornis*, n. gen., n. sp.: 4, Top view of a test in better proportion than Figs. 2 and 3; 5, natural group of seven tests, one standing aside from the rest; 6, cross section of a test to show its cylindrical form, and two hollow ridges on its roof, the one to the right swollen and sending out a horn, also hollow; 7, under view of a test with its floor, the cement, cut off to show the line of contact of test side walls with the cement.

value; and as the two ridges converge both anteriorly and posteriorly they tend to circumscribe a dorsal area as if by walls, and so we devise the generic name *Valletofolliculina* for this genus and the name *bicornis* for this species.

Its chief characters are: Hollow dorsal ridges prolonged as hollow horns with complex ending; wide flaring mouth from very narrow end of short uprising neck; long pear-shaped reclining body; wide cement; no internal valves; and meganucleus of one lobe.

The posterior end of the test does not show a pit as Dons found, and as far as preserved specimens reveal the tail end of the animal is rounded and often broken loose from the test.

Dredged April 7, 1951, 8-10 feet, 30 per cent salinity in Tomales Bay, Calif., on inner face of bivalve shells, 1 inch and less in length. Tests scattered in groups of up to seven.

DISCUSSION

The chief architectural effects produced by folliculinids result, as in human habitations, from the placement and form of cavities and their walls, and not from solid masses as in crystal aggregates.

As far as known, all skeletal structures in folliculinids arise from the outer surfaces of active protoplasm, by secretion and accompanying activity of cilia. Here ciliary activity accompanies secretion as in many metazoa, notably molluscs and vertebrates. But having made superficial skeletal structures, cement, tests, valves, etc., the protoplasm *retires* and leaves the secreted exoskeleton to permanently represent the former outline and location of the active protoplasm. Even the spiral ridges on the necks of many kinds of folliculinid tests are not simple solids but made up of layers, as long since recognized by Wright (1859), and arise from special ciliary and secretion activities (Andrews, 1923; Das, 1947).

Some of the marked architectural effects caused by cavities and their walls in folliculinids are the following: Many have front halls or atria which in *Parafolliculina* often have side alcoves; the genus *Pebrilla* has the dwelling cavity marked off into anterior and posterior rooms by an external construction, which is not made by outside compulsion but, as Fauré-Fremiet saw (1936), by special action of the swimming phase, in constructing first the posterior chamber and later adding an anterior room. There may be also

median posterior outpushings of the main chamber as seen in *Pebrilla*, in the above *Parafolliculina roestensis*, and as a long tubular affair in the upstanding stalked *Pseudofolliculina mellita* (Laackmann) (Dons, 1927) from deep Antarctic waters. Test walls may show numerous outpushings or subordinate chambers as seen by Silen (1947) in some *Folliculina gigantea* if crowded against others, with pouches on each side of an obstacle, and Dons (1927) figures some individuals of *Lagotia simplex* with side alcoves from the test bodies; finally, in the remarkable *Mirofolliculina limnorae* (Giard) (Dons, 1927) many and variable pouches from the main chamber become a generic character. These folliculinids settle upon rough surfaces of the outside of the wood-boring isopod *Linnoria*, and Fauré-Fremiet thought the pouches were formed by the secretions of the artificer flowing out about obstructing roughnesses, hairs, of the substrate. We note that the protoplasm that makes these pouch walls may remain anchored to the bottom of each pouch as in one figure of Fauré-Fremiet, or it may withdraw as in another figure and as represented by Giard. In many specimens of this species sent me from Friday Harbor, Wash., by Dr. John Buck there are many instances of such withdrawals of plasma from former secretions; and many show the pouches not all on one level, but posteriorly and laterally, below and above, as if the test had "broken out" in pustules, suggesting to me that obstacles to outflow of the plasm in test making cause a general irritation that results in pouch formation far from the points of contact.

With the above facts in mind, we have only to assume the test-making phase of *Valletofolliculina bicornis* has special protoplasmic dorsal ridges; to modify what is known of test making in some other folliculinids and postulate, the test is made as follows. The swimming phase, after gliding over a suitable building site, relaxes as if a mere drop wetting the substrate and then secretes over the part of the substrate it covers the attaching cement, whose form and size will record the form and size of the animal at that period; next it resumes a cylindrical form but with two protoplasmic ridges along its upper face, each of which projects as a hornlike pseudopod ending with some filose activity suggesting the anchoring organs of stentor (Andrews, 1945) but yet not forming the real anchoring organ. This protoplasmic cylinder with ridges then se-

cretes the covering of chitin-like exoskeleton that will remain as the record of the form and position the protoplasm then had. The tips of the pseudopods appear to act somewhat as in forming a scopula, as found in vorticellids as made out by Fauré-Fremiet (1905); the rest of the pseudopod secretes the walls of the horns and then retires into the mass of the ridges. As the ridges secrete their covering it cuts them off from the cavities of the horns, and later when the entire cylinder forms its secreted covering it cuts off the dwelling cavity from the cavities in the ridges from which the plasm retreats into the main mass of the cylinder.

No uses are known for the ridges or the horns. Possibly the ridges might give some protection against the rasping effect of some wandering gastropod's horny teeth. Conceivably the filose activity at the tips of the pseudopods might have some sensory part to play in parking of tests in groups!

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ZOOLOGY.—*A new cyprid ostracod from Maryland.*¹ EDWARD FERGUSON, JR.,² Orangeburg, S. C. (Communicated by Willis L. Tressler.)

Two females and one male ostracod belonging to a new species of the genus *Candona* were collected during January 1951 from a drainage ditch on Eldon Hall farm near Princess Anne (Somerset County) Md. This paper describes the new species *Candona hoffi*, named in recognition of C. Clayton Hoff, an outstanding contemporary investigator of American fresh-water Ostracoda.

Genus *Candona* Baird, 1845

The valves of members of this genus are white, sometimes transparent, occasionally with a mother-of-pearl sheen. The surface of the valves

is smooth, sometimes with hairs. The shape of the shell varies, generally elongated ovoid to reniform and in some representatives the dorsal margin is straight and the ends are truncate. The swimming setae of the antennae are absent; the antenna of the female has five podomeres, and that of the male has six podomeres that result from the division of the penultimate podomere. The penultimate and ultimate podomeres of the mandibular palp are short and rounded. The respiratory plate of the first thoracic appendage is rudimentary, usually provided with two unequal setae, and never with more than three setae. The third thoracic appendage, which frequently has four podomeres, sometimes appears to consist of five podomeres through a division of the penultimate podomere. The terminal podomere of the third thoracic appendage is short and bears two backwardly directed setae. The furcal ramus is exceptionally well developed and bears two strong claws and one or two setae.

¹ A contribution from the Department of Biology of the State A. and M. College, Orangeburg, S. C.

² Appreciation is expressed to Dr. Willis L. Tressler, of the United States Navy Hydrographic Office, for his aid in the preparation of the drawings.